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XIV.—*Some Account of a diœcious Rotifer allied to the genus* Notommata *of Ehrenberg*. By Thomas Brightwell, F.L.S.

[With a Plate.]

Notwithstanding the laborious researches of Ehrenberg and other eminent zoologists among the microscopic animals, much obscurity still rests on their precise characters, and their mode of increase and propagation.

The Rotatoria of Ehrenberg (Systolides of Dujardin) are characterized as androgynous, combining the male and female parts in the same individual; but the facts we have to adduce go to show that, at least, one of the more highly organized species is diœcious; and that it is propagated by a union between the sexes, analogous to that of animals placed in a much higher class.

It appears that M. Doyère has discovered male organs and spermatozoa in the Tardigrades, a family few in species, but composed of two or three distinct genera. They are incorporated by Dujardin among the Systolides, and form, according to this author, a passage from the Systolides to the Helminthides on the one hand, and the Annelides and Arachnides on the other. In like manner the animal we have to describe may perhaps be found to connect this order with the Tunicata by some of the minute free gelatinous animals placed in this class.

We first discovered this animal six or seven years since in a small pond in this neighbourhood. It is found for a few weeks only, in the warmest weather, and in some seasons it disappears altogether. Last summer, and in other years, not a specimen could be found, but this year (1848) it has appeared rather plentifully.

The female (see Pl. VI. fig. 1) bears a general resemblance to *Notommata Syrinx* and *N. clavulata* of Ehrenberg, but it is

somewhat larger than either species, and is without any caudal appendage whatever. It has also no anal opening, the fæces being rejected by the mouth.

The general arrangement of the internal anatomy is analogous to that of *N. Syrinx*. The stomach is a pyriform sac or bag with many cells, but without any lower opening. The two reniform bodies above the stomach, supposed to be hepatic or pancreatic, are very conspicuous in this species. Beneath the stomach and lying transversely and of a horse-shoe form is placed the ovarium, which in the young is a cylindrical bipartite organ, the parts being united by a central knob. On one side of the body is a very delicate membranous bag, often plicated. This organ is united to the ovisac, lying below, which ovisac receives the ova or fœtus, and is connected with a conspicuous opening in the side of the animal from which the ova and young are expelled. On the other side is placed the singular structure deemed by Ehrenberg the fertilizing organ. This consists of two or more delicate vermiform tubes running from the neck to the lower part of the body and curled at each extremity, and of a minute muscle or fibre running from the upper to the lower coil of the tubes internally, and upon which are arranged sometimes as many as twenty little cylindrical bodies somewhat resembling *Vorticellæ*, and in the interior of which may be discovered a strong spiral vibratile motion varying in intensity *.

At the bottom of the body of the female is generally seen a fœtus (see Pl. VI. fig. 3), which is found in all states, from the earliest period of gestation to a perfectly developed animal, and in which, in its maturer state, may be detected, while still in the body of the mother, the red eye, cilia actively playing, and most of the other organs of the adult animal. The young, when mature, are expelled from the side of the parent by the opening above mentioned, and are evolved by a violent parturition. They are for some days considerably smaller than the parent animal. The eye, the stomach, the two kidney-shaped bodies above it and the double ovary beneath may be most clearly seen in the female young. In other individuals, but more rarely, are seen one or two large round ova. When two ova are present they are placed one above the other, the lowest being always found opake and striated, and the upper one more or less transparent and reticulated, or covered with minute follicles. In these transparent ova may be detected the germ, or more advanced state, of the opake ova (see Pl. VI. fig. 4). The opake ova are dropped by the parent animal, but we have never seen any young in, or proceeding from, the ova.

* A quarter of an inch achromatic object-glass is necessary to see these organs.

The female preys on other Infusoria and Rotifera, and even on its own kind. Its most common food appears to be Infusoria of the genus *Gonium*, the cells of the stomach being constantly found distended with these animals. Large spinous Rotifers, such as *Brachionus Bakeri*, are not unfrequently seen entire in the stomach. The half or wholly digested food of the animal is rejected through the œsophagus.

The female is about half a line in length, and may be detected by the naked eye. The motion in swimming is slow and graceful, and the animal, having no prehensile organ, of course never rests.

The jaws of the female (see fig. 5) are curiously toothed, but seem more calculated for nipping and holding than for mastication.

The male animal (see Pl. VI. fig. 2) is about half the size of the female, and differs from it in form, being much shorter and of a rude triangular shape. It is more difficult to detect than the female, being exceedingly transparent, and from the emptiness of the body appearing little more than a transparent ciliated bubble. It is very active, and occasionally puffs out the sides of its body, so as entirely to alter its form, and remains thus distended some time.

On the most careful examination of the males we have never been able to discover any jaws, gullet, stomach, or hepatic organs in them, nor any appearance whatever of extraneous matter being received into the body.

At the bottom of the body on one side is a conspicuous round sperm-vessel or testis, in which, under a high power, spermatozoa in active vibratile motion may be seen, and at its external side a duct, closed by distinct lateral muscles. Connected with the testis is a well-defined intromittent organ and a conspicuous passage or opening for its extrusion from the body of the animal. In the opposite lower angle are three small irregularly-formed kidney-shaped bodies connected with an angular lobe or muscle lying beneath them. The male is also furnished with the delicate membranous plicated bag and rudiments of the curled tubular structure found in the female.

Observations upon the Ova.

June 15*th.*—Placed a female in a trough, having one of the transparent ova above and a dark ovum beneath in its body.

June 16*th*, 8 A.M.—Could not find the dark ovum. The transparent ovum remained and was become nearly dark.

2 P.M.—Found the female dead. Examined the ovum occasionally for upwards of a week without perceiving the least change.

June 17*th*, A.M.—Placed four females with opake ova in a trough by themselves.

June 19*th*, 7 A.M.—Found two of the opake ova deposited and all the four females dead. These ova were preserved eight or ten days and underwent no change.

June 24*th*, 8 A.M.—Isolated a female which had one clear ovum and one opake as above. 4 P.M.—It had deposited the opake ovum, which was occasionally examined for eight or nine days, but no change was perceived.

July 26*th*, 9 A.M.—Isolated a female having a small imperfect dark ovum, about half the full size, adhering to the ovarium, and also in the lower part of the body a full-sized semitransparent ovum. 7 P.M.—Found the semitransparent ovum become opake, and the small imperfect ovum a full-sized semitransparent ovum.

July 27*th*, 9 A.M.—Found the opake ovum deposited.

The ovarium when fertilized becomes tumid, somewhat dark, and abounding in minute globules. From the centre, where it appears divided, the ova are extruded. At first the vesicle is very small and filled with the same fluid as the ovarium; as it enlarges the vesicle appears brownish and opake, enlarging by degrees into the above-mentioned beautiful semitransparent, follicled ova (see Pl. VI. fig. 6).

Observations as to the Union between the Sexes.

June 15*th*.—Placed a male and six females in a small glass trough by themselves, and two males and about thirty females in a large trough.

June 16*th*, between 7 and 8 A.M.—On examining the small trough observed that the male on approaching one of the females attached himself to its side by the spermatozoid projection, and remained so attached from twenty to thirty seconds. The same male acted precisely in the same manner with four other females. These five connexions took place in about fifteen minutes.

At 8 A.M.—Watched the two males in the larger trough more than half an hour, the males swimming close to many of the females, but no conjunction took place. Observed the males frequently attach themselves to the glass by their heads and distend their bodies.

At 5 P.M.—Saw one of the males in the larger trough attach himself to a young one of the other sex for about twenty seconds, and afterwards to a full-grown female for a somewhat longer time. Saw this last connexion in a clear light most distinctly. The end of the sperm-tube was attached to the side of the female, and the rest of the body of the male was quite free. Saw the same male soon after fix itself by its head to the glass and remain so for thirty seconds, and during this time it continued

puffing out and drawing in the sides of its body as if to give them their utmost dilatation.

June 20th, 5 P.M.—Placed a young female and a male in a trough by themselves and watched them very frequently till eleven at night, and though they came very near each other no conjunction took place.

June 21st, 8 A.M.—Found the female dead and the male alive. Put three other females to this male, and in a few minutes saw the male as soon as he approached one of the females attach his sperm-tube to its side and remain so attached fifty seconds. Soon afterwards he attached himself to another very young female and remained so attached seventy seconds. Could discern this latter connexion of the end of the sperm-tube with the side of the female very distinctly.

4 P.M.—Saw in the trough, by the aid of the microscope with a one-inch achromatic object-glass, a conjunction of a male with a female. On approaching the female the male attached himself by the sperm-tube to her side, and remained so attached nearly a minute. Saw this most clearly, but owing to the movement of the animals in the water it is almost impossible to see more than that there is a distinct adhesion.

Most of the above observations were made with a single lens only, of two inches focus, and the others with the microscope.

The animals seldom live above two or three days in the water-troughs, but in larger vessels they may be kept alive three or four weeks if they are supplied with water having *Gonia* in it.

The question, as to the fertilization of the ova, remains to be solved. It seems probable that they remain some time before the young are produced, and it may be, that being buried in the mud they remain there during the winter, and that the young are not hatched till the warm weather of the ensuing summer. On the other hand it is possible that ova are only produced by the unimpregnated females, and that these ova are not fertile. Careful and long-continued observations are necessary to determine these points.

It is well known that several species of insects, in their imago or perfect state, take no food, though provided with the usual organs for that purpose; but the case of the male of this Rotifer, destitute of instrumenta cibaria and all digestive organs, is, we believe, without precedent.

Probably other dicœcious animals of the same class exist which have not come under observation. The whole subject invites the further attention of naturalists, and we are glad to know that, with reference to the immediate subject of this paper, they may expect from the able pen and pencil of Mr. John Dalrymple those

further details respecting it, which his eminent attainments and metropolitan opportunities will so well enable him to afford.

EXPLANATION OF PLATE VI.

Fig. 1. Female highly magnified.
— 2. Male ditto.
— 3. Very young fœtus in the female.
— 4. Semitransparent ovum with the opake ovum inside.
— 5. Jaws of the female. The internal parts of the male and female will readily be recognized from the descriptions.
— 6. Ovarium with ova vesicles proceeding from it.

XV.—*Characters of seven new species of* Helix, *with amended descriptions of some species previously described, and Notes on others requiring remark.* By W. H. Benson, Esq., late Bengal Civil Service.

The following seven species of *Helix* are not described in the valuable monograph of the genus lately published by Dr. L. Pfeiffer, a work which deserves to find a place in the library of every conchologist. The first volume, besides monographs of several allied genera of less extent, contains the characters of upwards of 1130 species of *Helix*, inclusive of *Nanina* and *Carocolla*. I have also recast the characters of three of the species described by me in 1836, and included in the monograph, but which Dr. Pfeiffer had not had an opportunity of inspecting when his work was published; and I have noticed a few points in which correction will be required, where a species has either been twice admitted under different names, or has been founded on the young of a shell belonging to a different genus.

Other new species of *Helix* collected in India, at the Cape of Good Hope, and the Mauritius, I hope to describe on a future occasion.

1. *Helix Orobia*, nobis, n. s.

Testa perforata, depresso-globosa, tenuiuscula, radiatim plicato-striata, striis concentricis granulato-decussata, luteo-cornea, fascia infra periphæriam rufo-fusca ornata, versus apicem rufescente, basi pallidiori; spira rotundata, apice planato; anfractibus $5\frac{1}{2}$, superioribus planulatis, ultimo prope suturam tumidiore, periphæria subangulata; apertura subquadrato-lunata, peristomate recto, intus late albido labiato; margine columellari subverticaliter descendente, vix reflexo, perforationem subtegente, angulum cum margine basali expansiusculo efformante.

Diam. maj. 35 millim., min. 31. Axis 16 mill.

Hab. Darjiling regione Sikkim montium Himalayanorum.

Mus. nost. et Soc. Ind. Orient. Angl. Lond.